Review of: "A single hidden variable interpretation of the quantum wave function"

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Potential competing interests: No potential competing interests to declare.

I had a review ready before the author posted the third version of the paper, already with a lot of good changes and mentioned in a comment that there is going to be a fourth version soon. I have decided to keep my review before seeing the fourth version and now that it's available I have looked at it as well. I will post here my old review as well as my comments on the fourth version below.

OLD REVIEW:

The following paper attempts to explain entanglement with erasable micro-observations of one of the systems by the other. The idea at hand is truly interesting, however, the paper fails to build upon it and address the respective advantages, shortcomings, other arising issues. While its newer iterations do fix certain problems with its presentation, the work, as a whole, is in dire need of more thought and polishing. Below are the more egregious problems I have encountered:

1. It is not clear at all why all objective uncertainty should be transformed into subjective uncertainty through an entanglement. The author suggests that this happens through micro-observations but no abstract or concrete mechanism is defined that would govern this behavior. Neither there is a provided mechanism to understand when these micro-observations happen.

2. Following up on my previous point and assuming that all the objective uncertainty is transformed into a subjective uncertainty, a physical mechanism for how the subjective uncertainty can transform back to objective uncertainty is not presented. The idea of “reintroducing objective uncertainty” should be discussed much more than the one small mention in the paper.

3. The author doesn't add anything original to the zigzag causality discussion, and this discussion mostly does not to do with the most important part of the paper. The author, without addressing any of the issues mentioned above, starts discussing how their viewpoint will work in some extreme case of nonlocality. This particular point hinges on the assumption of zigzag causality that helps to preserve the relativistic principles, while having nonlocal quantum correlations. The author makes numerous assumptions about the uncertainty in a zigzag causality, a "past light cone"

local micro-observations etc. This chain of assumptions on assumptions just dilutes the idea of micro-observations while not answering the more foundational questions and only making the paper less clear.

While the idea of micro-observations causing entanglement is very interesting it needs a lot more discussion, the zigzag causality section only adds more questions instead of answering the existing ones. In this form, I cannot review this paper anything higher than 2/5.

COMMENTS ON THE V4:

I think the author has made very good changes to the paper. The paper is much ore clear on what its main discussion is about and what the most important points are. All of the points from my review have been somewhat addressed. I still think that the non-locality discussion is not that important for this paper given that it tackles ideas of non-determinism and intrinsic uncertainty and micro-measurements in the environment.

As it currently stands I updated my review to 3/5, here's why.

1. The philosophical discussion in the end which the author presents in favor of non-determinism has a major flaw. As the author mentioned in that part “consider AI, which needs (pseudo) random numbers in order to learn”. The most important part here is that those random numbers are pseudo random and a completely deterministic system of a classical computer still is able to train that AI. This is different from the authors discussion on objective uncertainty being pseudo random in the sense of the non-observable system giving random values. That “workaround” is flawed because if the pseudo-random value is given by a system that cannot be observed it may as well be completely random. If you can see the difference of the pseudo-random variable from a real random variable then you can observe the system to some extent therefore it is an observable system.

2. It is very important to understand how macroscopic observations are different from micro-observations. Micro-observations are presented as the mechanism of entanglement and are erasable. Why do we lose that property when going from micro-observations to macroscopic observations (which contrary to intuition do not consist of many micro-observations in this picture). One would assume that a macroscopic observation cannot see the difference between subjective and objective uncertainty but the micro-observation should see the difference. Otherwise there's no point in introducing subjective and objective uncertainties. These topics are very important and are not discussed to a sufficient degree in the paper.

In sum, I cannot recommend the paper for publication in it's current state. However, I recognize that the paper has changed to the better in the newer versions and I hope this trend will continue.